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19. ABSTRACT (Continue on reverse if necessary and identify by block number) A variety of new materials for ambient temperature polymer electrolyte batteries are under investigation. These materials include some derivatives of polyether complexes with plasticizer salts. Phase diagrams, X-ray diffraction, nuclear magnetic resonance, electrochemical stability and ion transport studies have been carried out, to fully evaluate these materials. Prototype electrochemical cells based on these polymer electrolytes have been subjected to extended cycling at various temperatures in order to assess the performance efficiencies as well as changes within the cell structure.			
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# AMBIENT TEMPERATURE SOLID POLYMER ELECTROLYTE DEVICES

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Though considerable success has been achieved in the development of solid polymer electrolyte lithium rechargeable batteries based on  $\text{Li/TiS}_2$  and  $\text{Li/V}_6\text{O}_{13}$  electrode couples, the energy and power densities of these battery systems at ambient temperature remains low. This is due to the high internal resistance of the cell which is a direct result of the low ionic conductivity of the electrolyte. Consequently the polymer electrolyte cells have to be operated at elevated temperatures to obtain reasonable electrochemical performance. In order to operate solid polymer electrolyte batteries at ambient temperature with high energy and power densities, highly ionic conducting electrolytes are required.

We have investigated the following three groups of polymeric electrolytes : (1) non-aqueous gels based on lithium polymeric salts; (2) composite polymer blends of low and high molecular weight ether groups complexed with organic lithium salts; (3) poly(ethylene oxides) with plasticizing salts based on lithium organic salts.

Solid polymer electrolytes based on lithium salt doped into highly conducting non-aqueous gels exhibited an ionic conductivity of  $4.5 \times 10^{-4}$  S/cm. Experimental cells with the  $\text{Li/V}_6\text{O}_{13}$  couple had an OCV of 3.6 V. On constant current discharge at  $100 \mu\text{A}$  ( $20 \mu\text{A}/\text{cm}^2$ ), the voltage decreased to 2.0 V, then had a flat discharge for 14 h before reaching the preset cut-off voltage at 1.5 V. Cycling experiments are in progress and results of the first five cycles demonstrated good rechargeability.

Composite polymer blends were investigated for their ionic conductivity and glass transition temperatures, where low molecular weight liquid poly(ethylene glycol) was blended with high molecular weight poly(ethylene oxide) and used as a polymeric matrix in dissolving  $\text{LiCF}_3\text{SO}_3$  salt. Some compositions of  $(\text{PEO-PEG})_8\text{LiCF}_3\text{SO}_3$  solid polymer electrolyte blends also demonstrated very high ionic conductivity. Detailed thermal and electrochemical analyses are in progress.

Plasticizer salts with modified poly(ethylene oxide) were considered for a detailed investigation of their physico-chemical properties. The general formula of the plasticizer salts is represented by  $(\text{C}_n\text{X}_{2n+1}\text{Y})_2\text{N}^-\text{M}^+$ , where  $n = 1$  to 4, C is carbon, X is halogen, Y is a functional group either acetyl or sulfonyl, N is nitrogen and M an alkali metal. These two group of salts, the bis-perhalogenoacyl imides and bis-perhalogenosulfonyl imides of alkali metals were investigated by complex impedance analysis. Preliminary results on the ionic conductivity were not very encouraging.

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